INTEGRATING CLIMATE CHANGE IMPACTS TO IMPROVE UNDERSTANDING OF COASTAL CLIMATE CHANGE: HEAVY RAINS, STRONG WINDS, AND HIGH SEAS IN COASTAL HAWAII, ALASKA AND THE PACIFIC NORTHWEST

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Introduction

Coastal storms, and the strong winds, heavy rains, and high seas that accompany them pose a serious threat to the lives and livelihoods of the peoples of the Pacific basin, from the tropics to the high latitudes. To reduce their vulnerability to the economic, social, and environmental risks associated with these phenomena (and correspondingly enhance their resiliency), decision-makers in coastal communities require timely access to accurate information that affords them an opportunity to plan and respond accordingly. This includes information about the potential for coastal flooding, inundation and erosion at time scales ranging from hours to years, as well as the long-term climatological context of this information.

The Pacific Storms Climatology Project (PSCP) was formed in 2006 with the intent of improving scientific understanding of patterns and trends of storm frequency and intensity - "storminess"- and related impacts of these extreme events. The project is currently developing a suite of integrated information products that can be used by emergency managers, mitigation planners, government agencies and decision-makers in key sectors, including: water and natural resource management, agriculture and fisheries, transportation and communication, and recreation and tourism.

The PSCP is exploring how the climate-related processes that govern extreme storm events are expressed within and between three primary thematic areas: heavy rains, strong winds, and high seas. To address these thematic areas, PSCP has focused on developing analyses of historical climate records collected throughout the Pacific region, and the integration of these climatological analyses with near-real time observations to put recent weather and climate events into a longer-term perspective.

Historical Storm Event Anatomies

As part of the initial release of products for PSCP, a dedicated web portal provides a set of historical storm "event anatomies" as one of the project's targeted information products. These event anatomies include a summary of sector-specific socioeconomic impacts associated with a particular extreme event, as well as its historic context in terms of long-term climate. The intent is to convey the impacts associated with extreme events and the causes of them in way that enable users to easily understand them. The event anatomies are also intended to familiarize users with in-situ and remotely sensed products typically employed to track and forecast weather and climate. Additional event anatomies will be developed over coming years as resources permit.

The event anatomies are web-enabled using a standards-based, vendor-neutral and open-source enterprise portal architecture that, by design, provides personalization, single sign-on capability, and content aggregation from different sources while also being a web server for the presentation layer of the information systems. Figure 1 shows an example of the web-based Event Anatomy showing the products related to Hurricane Iniki and the observed impacts on the island of Kaua'i during its landfall in August 1992.

The Hurricane Iniki event anatomy is a first example of an initial set of four currently under construction. It illustrates the prototypical content and to demonstrate how such content will be served. It is intended to provide a means to solicit input from the PSCP Product Development Team and others prior to proceeding further towards completion of the other event anatomies in the initial set.

Derived Data Products

The project's web-based utilities allow users to query from among a set of standard parameters for each of the three thematic areas, and each query will generate a map that displays results plotted as a set of interactive station/system icons. Selecting a particular icon will reveal basic information about the station/system and provide a list of links to specific PSCP products and accompanying data sets (e.g., annual rates of change; annual, seasonal, and monthly event magnitudes, long-term trends, and event recurrence intervals of strong winds, heavy rains, and high seas). Users will also find links to station and data/product metadata, graphs, satellite imagery and other related information for each station.

In terms of climate applications, initial efforts have focused on improved understanding of trends in extreme rainfall for coastal areas of Hawaii, Alaska, and the Pacific Northwest (Kruk and Levinson 2008; Levinson and Kruk 2009). Figure 2 is a map showing an example of one of the heavy rains derived data products, in this case the trend in annual precipitation for all coastal stations in the Pacific Northwest.

The products and data sets accessible via this utility represent the results of analyses by the theme-specific data integration and product development teams of NOAA's Integrated Surface Data (ISD) mean sea level pressure and wind speed data; the Global Historical Climate Network (GHCN) precipitation dataset; the National Water Level Observing Network (NWLON) sea level station records; the National Data Buoy Center (NDBC) wave buoy records; the U.S. Army Corps of Engineers' Coastal Data Information (CDIP) buoy data, and data from other observing networks as the project develops.

Summary

Understanding the long-term variability and trends in coastal climate has grown in public awareness given the potentially severe impacts related to sea level rise coupled with changes in storminess. Previous research and operational products have typically focused on whether monthly, seasonal or annual averages of temperature and precipitation have varied over time, and whether there is a discernible trend in these quantities. In order to better address the observed trend in coastal impacts related to climate change, the Pacific Storms Climatology Project has developed analyses of storminess in the Pacific region based on the observed impacts of storms related to heavy rains, strong winds, and high seas. Future work will focus on expanding the number of historical event anatomies and derived data products for use by decision makers and the public. Online access to all PSCP products, including event anatomies and derived data products, can be found at http://www.pricip.org/.

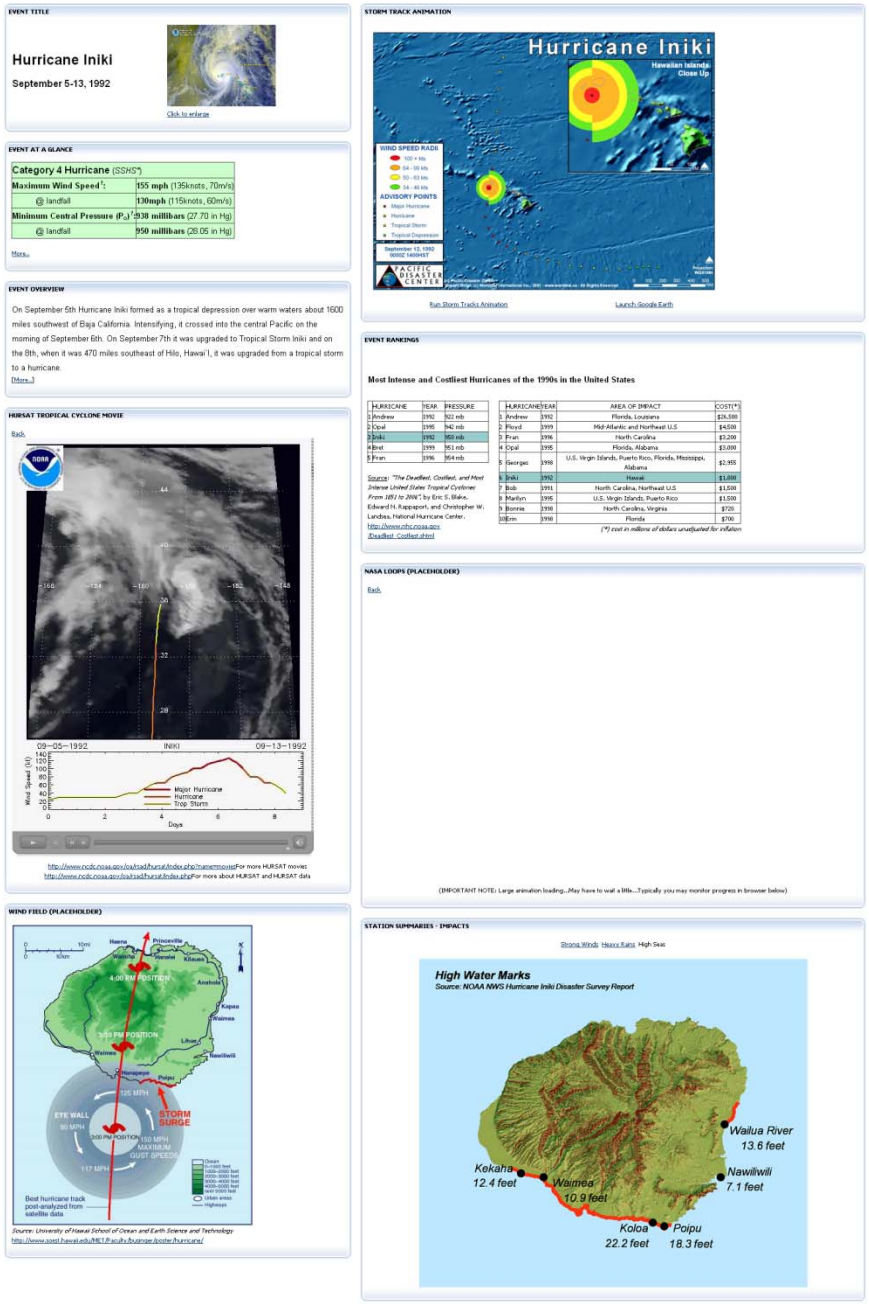

Figure 1. Example of a Historical Storm Event Anatomy developed using a suite of products describing the observations and impacts related to the landfall of Hurricane Iniki on the island of Kauai in August 1992.

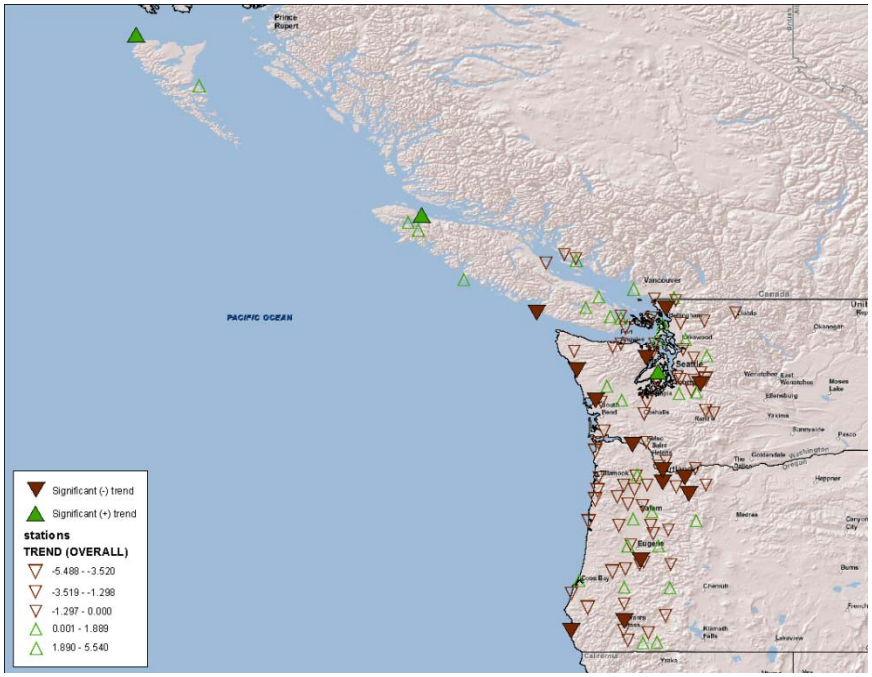

Figure 2. Example of a Derived Data Product for the Pacific Storms Climatology Project (PSCP): the trend in annual precipitation for stations within 200 km of the coast in the Pacific Northwest using data from the Global Historical Climate Network (GHCN) Daily dataset. Increasing trends in annual precipitation are shown as upward green triangles with decreasing trends shown as downward brown triangles. Trends that are statistically significant at the 95% confidence level are plotted as solid colors. The GHCN-Daily dataset can be accessed online at http://www.ncdc.noaa.gov/oa/climate/ghcn-daily/.

References

Kruk, M.C., and D.H. Levinson, 2008: Evaluating the impacts of climate change on rainfall extremes for Hawaii and coastal Alaska. Proceedings, *24th Conference on Severe Local Storms*, Savannah, GA, 27-31 October, American Meteorological Society.

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